

REMARKS

Claims 1-33 are pending in the present application. In the Office Action mailed May 15, 2007, the Examiner rejected claims 1-9 and 12-26 under 35 U.S.C. §102(e) as being anticipated by Larson et al. (US Pub. 2004/0155653) (hereinafter Larson). The Examiner next rejected claim 27 under 35 U.S.C. §103(a) as being unpatentable over Larson et al. Claims 10, 11, and 33 are rejected under 35 U.S.C. §103(a) as being unpatentable over Larson et al. in view of Haacke et al. (Magnetic Resonance Imaging, John Wiley and Sons, 1999) (hereinafter Haacke). Claims 28-32 are rejected under 35 U.S.C. §103(a) as being unpatentable over Larson et al. in view of Ho et al. (US Pub. 2003/0216637) (hereinafter Ho).

The Examiner objected to both the specification and the drawings because reference 106 is not shown in the drawings. A replacement sheet correcting Figure 3 to include reference 106 is being filed herewith. As such, Applicant believes that the objection has been overcome.

The Examiner rejected claim 1 under 35 U.S.C. §102(e) as being anticipated by Larson. Applicant respectfully disagrees. Larson does not disclose, teach, or suggest all of the limitations set forth in claim 1.

To begin, Larson does not disclose, teach or suggest determining “motion in the region-of-interest directly from non-spatially-encoded MR non-imaging data” as set forth in claim 1. *Application*, claim 1 (emphasis added). Applicant agrees that Larson may teach the use of non-imaging data. *Larson*, ¶ 0060. However, Larson does not teach or disclose the use of non-spatially encoded data as set forth in claim 1. For example, Larson may use spatially encoded data not used for imaging, but used for timing purposes. Further, Larson teaches the use of non-imaging data in “combination with additional data.” *Id.* Applicant, on the other hand, teaches determining motion directly from non-spatially encoded, non-imaging data; not in combination from other data.

In addition, Larson does not teach or suggest determining motion from data acquisition that happens “as the given k-space trajectory passes through or near the k-space origin at least once every repetition interval of a pulse sequence.” *Application*, claim 1 (emphasis added). Larson only teaches acquiring data along k-space trajectories that “relatively frequently” pass through the center or near center of k-space. *Larson*, ¶ 38. Though the Examiner asserts that this limitation is implied in Larson’s use of the phrase “relatively frequently,” Applicant respectfully disagrees. At best, “relatively frequently” is an indefinite term that may mean once every other repetition interval of a pulse sequence. Larson goes on to say that the trajectory should pass through the k-space origin enough that the appropriate temporal resolution can be obtained. *Id.*

There is nothing in Larson to indicate that a periodicity of once every *other* or *third* repetition interval would not be enough to obtain the appropriate temporal resolution. *See Larson*. As such, a periodicity of once every *other* or *third* repetition interval may be enough that the appropriate resolution can be obtained. Accordingly, Larson fails to teach a k-space trajectory to pass through or near the k-space origin at least once every repetition interval of a pulse sequence.

Accordingly, that which is called for in claim 1 is not shown, disclosed, taught, or suggested in the art of record. As such, Applicant believes claim 1, and the claims which depend therefrom, are patentably distinct from the art of record. In view of the foregoing, Applicant respectfully requests withdrawal of the §102(e) rejection of claim 1 and all claims depending therefrom.

The Examiner rejected claim 2 under §102(e) as being anticipated Larson. Applicant respectfully disagrees.

Larson does not teach or suggest all of the limitations of claim 2. In particular, Larson does not teach or suggest, nor has the Examiner asserted that Larson teaches or suggests, sampling the MR signal “before the onset of spatial encoding gradient.” *Application*, claim 2.

The Examiner has asserted that several of the limitations of claim 2 can be found in Larson. However, the Examiner has not asserted that all of the limitations of claim 2 are taught or disclosed in Larson. *See Office Action*, 05/15/07, pg. 4. In particular, the Examiner made no reference to Applicant’s limitation that sampling takes place “before onset of spatial encoding gradients.” *Application*, claim 2.

The Examiner rejected claim 5 under §102(e) as being anticipated by Larson. Applicant respectfully disagrees. Larson does not teach or disclose all that is called for in claim 5.

Larson does not teach or disclose processing the magnitude of MR signals to carry out slice tracking. The Examiner stated that Larson “discloses using motion information to adjust scan timing.” *Office Action*, 05/15/07, pg. 4. Claim 5, however, claims the use of magnitude information to carry out slice tracking -- not slice timing.

The Examiner rejected claim 15 under 35 U.S.C. §102(e) as being anticipated by Larson. Applicant has amended the claim to define over the art of record. Claim 15 calls for sampling MR data in each of a plurality of repetition time intervals for a central region of k-space prior to application of spatially encoding gradients in each repetition time interval, the k-space filled using a given k-space filling trajectory with MR data acquired from a region-of-interest having motion therein. Larson fails to teach or suggest that called for in claim 15.

Accordingly, that which is called for in claim 15 is not shown, disclosed, taught, or suggested in the art of record. As such, Applicant believes claim 15, and the claims which depend therefrom, are patentably distinct from the art of record. In consideration of the foregoing, Applicant respectfully requests withdrawal of the §102(e) rejection of claim 15 and all claims depending therefrom.

The Examiner rejected claim 28 under 35 U.S.C. §103(a) as being unpatentable over Larson, in view of Ho. Applicant has amended claim 28 to incorporate the subject matter of claim 29. Claim 29 has thus been cancelled. Though the Examiner rejected claim 29 under §103(a), Applicant believes claim 29 defines over the art of record. As explained above with respect to claim 15, Applicant believes that the art of record does not show, disclose, teach, or suggest the acquisition of MR data “for the central region of k-space prior to application of spatial encoding gradients of the pulse sequence.” As such, applicant believes amended claim 28 is patentably distinct over the art of record.

Accordingly, that which is called for in claim 28 is not shown, disclosed, taught, or suggested in the art of record. As such, Applicant believes claim 28, and the claims which depend therefrom, are patentably distinct from the art of record. In consideration of the foregoing, Applicant respectfully requests withdrawal of the §103(a) rejection of claim 28 and all claims depending therefrom.

Finally, the Examiner rejected claim 33 under §103(a) as being unpatentable over Washburn in view of Haacke. Applicant respectfully disagrees.

To begin, neither Larson nor Haacke teach or disclose all the limitations set forth in claim 33. Claim 33 calls for acquiring first and second sets of non-spatially encoded MR data. The Examiner concluded that the “k-space origin data for any given slice, by definition, are acquired with spatial encoding gradients set to zero, i.e. non-spatially encoded.” *Office Action*, 05/15/2007, pg. 9. According to the Examiner’s reasoning, if k-space origin data is acquired, then there is no spatially encoding gradient being applied. This reasoning, however, is incorrect.

The acquisition of k-space origin data for a given slice does not mean, “by definition,” that the spatially encoding gradients are set to zero. A gradient is a rate of change. In the case of MR technology, a spatially encoding gradient is achieved with the application of a varying magnetic field. This varying magnetic field is spread out over a defined area. In turn, this varying magnetic field cause spins to precess at a “range” of frequencies, with the particular frequency being dependent on a spin's location to the gradient (the varying magnetic field spread out over a defined area). A gradient includes a set, or range, of points – not one point. That is, a

gradient may include an origin point; however, an origin point is not a gradient. Data at a k-space origin that was acquired when a spatial encoding gradient was applied contains spatial information, whether or not it is a zero point. Thus, it is illogical to say that the origin a k-space means, by definition, that the spatial encoding gradient was set to zero. A “gradient” set to zero is not a gradient. Larson’s use of k-space trajectories suggests acquisition of only spatially encoded MR data. As explained above, the mere acquisition of k-space origin data does not mean acquisition with spatial encoding gradients set to zero, i.e., acquisition of non-spatially encoded data. Accordingly, the Examiner has not shown that Larson teaches the acquisition of first and second sets of non-spatially encoded MR data.

Next, the cited references do not teach or suggest non-spatially encoded MR data acquisition after the application ofrewinder gradient, as set forth in claim 33. While the Examiner asserted that Haacke discloses the use ofrewinder gradient pulses, there is no teaching or suggestion that a second set of non-spatially encoded MR data is acquired after suchrewinder gradient pulses. Accordingly, this limitation cannot be found in the cited references.

In light of the foregoing, Applicant respectfully requests the Examiner to withdraw the §103(a) rejection to claim 33

Accordingly, that which is called for in claim 33 is not shown, disclosed, taught, or suggested in the art of record. As such, Applicant believes claim 33, and the claims which depend therefrom, are patentably distinct from the art of record. In view of the foregoing, Applicant respectfully requests withdrawal of the §103(a) rejection of claim 33.

Therefore, Applicant respectfully believes that the present application is in condition for allowance. As a result, Applicant respectfully requests timely issuance of a Notice of Allowance for claims 1-28 and 30-33.

Applicant appreciates the Examiner’s consideration of these Amendments and Remarks and cordially invites the Examiner to call the undersigned, should the Examiner consider any matters unresolved.

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General Authorization and Extension of Time

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 07-0845. Should no proper payment be enclosed herewith, as by credit card authorization being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 07-0845. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extensions under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 07-0845. Please consider this a general authorization to charge any fee that is due in this case, if not otherwise timely paid, to Deposit Account No. 07-0845.

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